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U. S. DEPARTMENT OF AGRICULTURE,

BUREAU OF ANIMAL INDUSTRY.—CIRCULAR 207.

A. D. MELVIN, CHIEF OF BUREAU.

DIRECTIONS FOR CONSTRUCTING VATS AND DIPPING CATTLE TO DESTROY TICKS.

BY

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LETTER OF TRANSMITTAL.

UNITED STATES DEPARTMENT OF AGRICULTURE,
BUREAU OF ANIMAL INDUSTRY,
Washington, D. C., August 9, 1912.

SIR: I have the honor to transmit the accompanying paper entitled "Directions for Constructing Vats and Dipping Cattle to Destroy Ticks," by Drs. H. W. Graybill and W. P. Ellenberger, of this bureau. This circular, which is a revision of Circular 183, not only gives directions for preparing arsenical dips and for dipping cattle, but contains plans and specifications for the construction of suitable dipping vats. It has been prepared to meet the need for such information in connection with the work being done by the bureau in cooperation with State and local authorities for the eradication of the ticks which spread the contagion of Texas or southern cattle fever. I respectfully recommend that it be published in the circular series of this bureau.

Respectfully,

A. D. MELVIN,
Chief of Bureau.

Hon. JAMES WILSON,
Secretary of Agriculture.

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DIRECTIONS FOR CONSTRUCTING VATS AND DIPPING CATTLE TO DESTROY TICKS.

In the course of the work of tick eradication, which the Bureau of Animal Industry has undertaken in cooperation with the States of the quarantined area, there has arisen a demand for a brief publication treating of the preparation and use of arsenical dips and giving plans and specifications for a dipping vat suited to the conditions and requirements on the ordinary farm.[1] It is with the view of supplying this information that the present circular has been prepared. Those who may desire information on the life history of the tick or further information relating to methods of its eradication are referred to more extensive publications on those subjects.[2]

ARSENICAL DIPS.

Arsenical dips as agents for destroying cattle ticks have come into much favor during the past few years. This has been due to their efficacy, cheapness, the ease with which they are prepared, and the comparatively slight injury they cause to cattle when properly prepared and used. Homemade dips are the ones most commonly used, and are quite satisfactory in every way when ordinary care is observed in their preparation. Recently there has been placed on the market a proprietary concentrated arsenical dip which has given good results. This dip is prepared for use by diluting it with cold water in the proportions of 1 to 100. It is entirely possible that in the near future other concentrated arsenical dips will be successfully prepared. The only advantage in such dips is that comparatively little time is required in preparing the bath, but this advantage is largely counterbalanced by the fact that they are more expensive than homemade dips.

[1] In preparing the plans of the vat shown in this circular consideration has been given to the question of cost as well as to practicability of design. The plans for a vat that has been used extensively and with much success by bureau inspectors in the tick-eradication work in Alabama have been followed in part.

[2] Farmers' Bulletin 498, Bureau of Animal Industry Bulletins 130 and 152, and Bureau of Entomology Bulletin 72, all issued by the United States Department of Agriculture.

PREPARATION AND USE OF ARSENICAL DIPS.

The formula most commonly used in making an arsenical dip is the following:

Sodium carbonate (sal soda)	pounds	24
Arsenic trioxid (white arsenic)	do	8
Pine tar	gallon	1
Water sufficient to make 500 gallons.		

If for any reason a stronger dip is desired, 25 pounds of sodium carbonate and 10 pounds of arsenic trioxid may be used in place of the amounts given in the above formula. The stronger dip is required by the regulations of the Bureau of Animal Industry in the dipping of cattle which are to enter interstate commerce from quarantined areas, but for ordinary eradication work when immediate removal of the cattle to tick-free areas is not contemplated it will probably be best to use the weaker solution, and this is especially true during hot weather and when the animals are to be treated every two weeks.

In preparing the dip a large caldron or galvanized tank is required for heating the water in which to dissolve the chemicals. Twenty-five gallons of water should be placed in the caldron or tank and brought to a boil. The amount of sodium carbonate indicated in the formula is then added and dissolved by stirring. When this is accomplished, the required amount of arsenic is added and dissolved in a similar manner. The fire is then drawn, and the solution permitted to cool to 140° F., or this process may be hastened by the addition of cold water. The pine tar is then added slowly in a thin stream and thoroughly mixed with the solution by constant stirring. This solution should be diluted at once to 500 gallons.

If a large enough caldron or tank is available for preparing the dip, a greater quantity of solution may be prepared at one time, always, of course, in the same proportions as the above. In this way the time required in preparing the amount of solution necessary to fill a vat is reduced considerably. In case it is necessary to use a smaller container, say of about the capacity of 15 gallons, only half the amount of solution indicated should be prepared at one time, the quantities of ingredients used being half those in the formula. This will, however, require so much time in preparing the amount of solution necessary to fill a vat that when possible it is advisable to provide a larger vessel for dissolving the chemicals.

The caldron or tank and utensils used in preparing the dip should be kept free from grease or oil, as small quantities of these may envelop particles of arsenic and prevent or hinder the solution of the arsenic. It should also be borne in mind that when hard water is used in the preparation of the dip the dissolving of the sodium car-

bonate (sal soda) in the boiling water results in the formation of a fine white or gray insoluble powder or precipitate of lime salts, which may be taken for undissolved arsenic and thus lead to the belief that all of the arsenic has not gone into solution.

The arsenical solution, when prepared according to the above method, should be diluted as soon as the pine tar has been added in order that the tar may become properly emulsified. In the concentrated solution the tar tends to separate out, especially when the solution becomes cold, and collect in a layer at the bottom of the container. Even when this plan of immediately diluting the solution is followed a satisfactory emulsion is not always obtained and some of the tar may separate and go to the bottom of the vat.

If, however, the acids present in the tar are neutralized by the use of concentrated lye, a good emulsion of the tar in the diluted dip may be obtained.[1] The neutralization is effected by dissolving 1 pound of concentrated lye in a quart of water for every gallon of tar to be used and adding this solution to the tar, stirring thoroughly. When the acids of the tar have been properly neutralized the resulting mixture should be a bright, thick fluid of a dark brown color. Whether the acids have been neutralized or not may be determined by taking a small quantity of the tar on the blade of a pocket knife or on a sliver of wood and stirring it in a glass of water. If the acids have been neutralized the tar will mix uniformly with the water, whereas if they have not been neutralized the tar will float about in the water in the form of various sized globules that will settle to the bottom when the agitation of the water ceases. For all ordinary grades of tar 1 pound of lye to the gallon will be ample to effect neutralization; but if on testing it is found that the amount has not been sufficient, it will be necessary to add more lye solution—about a pint at a time for each gallon—until the test shows that the acids have been neutralized. The neutralized tar should be added to the diluted arsenical dip and not to the concentrated solution, with which it will not mix satisfactorily. When the neutralized tar is used the vat should be filled with diluted arsenic-soda solution prepared in the usual way. The required amount of neutralized tar, diluted with two to three times its volume of water, should then be added to the solution in the vat and thoroughly mixed with the same by stirring.

Before filling a vat the capacity at the depth to which it is necessary to fill it for dipping, if not known, should be calculated, and for future convenience the water line should be plainly marked at some point on the wall of the vat. Unless this is done it will be necessary either to calculate the amount of water in the vat each time it is filled or to measure it as it is placed in the vat, both of

[1] This method for emulsifying the tar has been suggested by the Biochemic Division of this bureau.

which procedures will consume considerable unnecessary time. The most convenient way to get the water into the vat is to conduct it through pipes, either directly from a pump or from an elevated tank used for storing water for farm purposes. Frequently, however, it is not possible to bring the water to the vat through pipes, and it becomes necessary to resort to the laborious process of hauling it in barrels on wagons or sleds.

In case the pine tar is added to the concentrated solution when it is made, in which case, as already stated, it is necessary to dilute the solution at once, the vat should be partly filled with water and then the arsenical solution added as it is made. For example, if the vat holds 2,000 gallons, about 1,500 gallons of water should be placed in the vat, then four times the amount of solution for making 500 gallons of dip should be prepared and mixed with the water, after which the vat should be filled to the 2,000-gallon mark. Within certain limits it is immaterial just how much water is added at first, provided, of course, ample allowance is made for the volume of the concentrated dip, so that when it is added the dip line will not come above the mark to which the vat is to be filled.

The capacity of the vats planned in this circular at a depth of 5 feet 3 inches is 1,470 gallons. In order to fill it to that depth with dip it will be necessary to prepare two batches of concentrated dip, each containing the ingredients necessary for making 500 gallons of diluted dip, and a third batch containing 7 pounds 9 ounces of arsenic and 22 pounds 3 ounces of sodium carbonate in case 8 pounds of arsenic are being used to the 500 gallons, or 9 pounds 7 ounces of arsenic and 22 pounds 8 ounces of sodium carbonate in case 10 pounds of arsenic are being used to the 500 gallons.

A stock arsenical solution is found convenient for replenishing the dip in a vat when it has gotten too low for dipping. A stock solution in which the ingredients for 500 gallons of dip are dissolved in 25 gallons of water may be used. In making up the stock solution the arsenic and sal soda for 500 gallons should be dissolved in the usual manner in 25 gallons of water. The tar should not be added to the stock solution. Special care should be observed to see that the solution after boiling and cooking measures 25 gallons, and any deficiency due to evaporation during boiling should be made up by adding cold water. Nineteen parts of water to one part of this solution will give the proper dilution. The tar, neutralized in the manner already described, should be mixed with the solution after it has been diluted, in the proportion of about half a pint for every 30 gallons of diluted dip.

In diluting stock solutions great care should always be observed in measuring the amount of solution and water used. A small error in measuring the amount of stock solution required is likely to cause a

considerable variation in the arsenic content of the dip, especially if the quantity prepared is small. If the variation happens to be in the direction of too low a per cent of arsenic the treatment may not prove effective, whereas if it happens to be in the other direction cattle that are treated may be injured or even killed. Care is especially necessary in the case of a certain highly concentrated proprietary dip, to be used at a dilution of 1 to 100. In using this great care should be observed in measuring the amount required, and the dilution recommended should be strictly followed. The same caution should be observed in the case of any other concentrated arsenical dips that may later appear on the market.

The arsenical dip may be left in the vat and used repeatedly, replenishing it with the proper quantities of water and stock solution when necessary. When, however, the dip becomes filthy through the addition of manure and dirt carried in by the cattle, the vat should be emptied, cleaned, and filled with fresh fluid. The frequency with which this should be done must be left to the owner, as the condition of the dip at any period after it has been made depends on a variety of conditions, such as the number of cattle dipped, the frequency of the dippings, etc. Even though the dip may not become very filthy, its efficacy decreases somewhat on standing, owing to gradual oxidation of the arsenic. It is therefore advisable to recharge the vat at intervals irrespective of the condition of the dip as to cleanliness.[1]

In order that dipping in arsenic may be both efficacious in destroying ticks and also harmless to the cattle at all times, it is of the highest importance that the dip be of the proper strength when made and that it be maintained as far as practicable at that strength. Due care in making the dip and in calculating the capacity of the vat will, of course, assure the correct initial strength of the dip. Providing the vat with a waterproof cover will do much to maintain the dip at its proper strength by preventing, on the one hand, concentration by evaporation, and on the other hand dilution by rains. A cover will also reduce the risk of cattle being poisoned during the intervals between dippings, especially when the vat is not protected by a fence. During rains the water from the draining pen and chute should not be permitted to run into the vat and dilute the dip.

At the conclusion of each dipping, especially if the vat is without a cover, it is well to mark the position of the surface of the dip on the side of the vat in order to determine at the next dipping whether there has been a change in the level of the dip. If the surface of the dip has fallen and it is known that the vat does not leak, there has

[1] Mr. R. M. Chapin, of the Biochemic Division, has devised a portable test case for testing arsenical dips in the field, which has been shown to be a practical success after extensive field tests. With this device, it is now possible to ascertain quickly the strength of the dip in a vat, and thus determine when the vat should be recharged. It is the intention of the bureau to place test outfits in the hands of the men engaged in tick eradication.

been a loss of water by evaporation and consequently an increase in the strength of the dip. In order to bring the dip down to its former strength water should be run into the vat until the dip surface reaches the mark made at the last dipping. If the fall has been due to the vat leaking, the strength of the dip has not been altered, and consequently water alone should not be added. If the dip surface has been raised by rain the amount of water added in this way should be determined by calculation, and for every 19 gallons of water 1 gallon of the stock solution previously mentioned should be used.

PRECAUTIONS IN THE USE OF ARSENIC.

Because of the fact that arsenic is a poison, great care should be observed in caring for it after it is purchased from the druggist, in order that persons and animals may not be accidentally poisoned. The dip at the time it is being made and also after it is diluted should be handled and protected as a poison. Unless such precautions are observed accidents are very likely to occur. When, however, arsenic is handled with the proper care, there is no more danger in its use on the farm than in the use of a number of other poisons that are commonly and regularly employed by farmers for destroying insect pests of plants and obnoxious rodents.

Persons using the dip, especially with the spray pump, should not subject their hands and other portions of the body, by permitting their clothing to become wet, to the action of the dip any more than is necessary, and it is well to wash the hands thoroughly after each spraying, especially when they are frequently exposed to the dip. At the time the dip is being prepared, care should be observed not to inhale the vapor arising from the caldron or kettle, and during spraying the same precaution should be exercised against the inhalation of the spray.

In making the dip, weights and measures should not be guessed at, and the arsenic especially should be weighed with the greatest care.

Cattle should always be watered a short time before they are dipped. After they emerge from the vat they should be kept on a draining floor until the dip ceases to run from their bodies; then they should be placed in a yard free of vegetation until they are entirely dry. If cattle are allowed to drain in places where pools of dip collect, from which they may drink, or are turned at once on the pasture, where the dip will run from their bodies on the grass and other vegetation, losses are likely to result. Crowding the animals before they are dry should also be avoided, and they should not be driven any considerable distance within a week after dipping, especially in hot weather. If many repeated treatments are given the cattle should not be treated oftener than every two weeks.

In addition to properly protecting vats containing arsenical dip when not in use, caution must also be observed when vats are to be emptied for cleaning. The dip should not be poured or allowed to flow on land and vegetation to which cattle or other animals have access. The best plan is to run the dip into a pit properly protected by fences. The dip should also not be deposited where it may be carried by seepage into wells or springs which supply water used on the farm.

Dalrymple and Kerr[1] have suggested a method of rendering the arsenical dip harmless by the use of air-slaked lime and copperas (ferrous sulphate). This method should not, however, be used alone, but rather as a precautionary measure supplementary to the plan suggested above for disposing of the dip. The process consists in using 6 pounds each of air-slaked lime and copperas to each 100 gallons of dip to be treated. The required amount of lime is first added to the dip and thoroughly mixed with it by stirring. After this treatment the dip should be permitted to stand for at least an hour. The copperas should then be dissolved in hot water and the solution while still hot should be added slowly to the dip and well mixed with the same by stirring. The dip should then be permitted to stand for at least 12 hours, after which it may be removed from the vat and disposed of in the way suggested.[2]

METHOD OF DIPPING.

The procedure to be followed in dipping animals on a farm depends on the end that is sought in undertaking the treatment. If it is simply desired to reduce and keep down the infestation of ticks on a farm it will only be necessary for the owner to keep his animals under observation and dip them when, according to his judgment, treatment is necessary to keep the ticks under control. Such a procedure may well be followed where the regular tick eradication is not under way; that is, in instances in which it is not yet practicable or expedient to rid farms completely of ticks.

If, however, it is desired to rid the farm completely of ticks—and this should be the purpose in every case in which it is practicable and expedient—it will be necessary to dip all cattle, and also any horses, mules, or asses that may harbor the cattle tick, at regular intervals until all ticks have disappeared from the farm. The purpose of such

[1] W. H. Dalrymple and A. P. Kerr. Bulletin 132, Louisiana Agricultural Experiment Station.

[2] The Biochemic Division of this bureau is at present investigating the process proposed by Dalrymple, together with other possible processes for attaining the same end. The essential part in the process is played by caustic lime, which when present in excess precipitates all but practically inappreciable traces of the arsenic as insoluble calcium arsenite. It is therefore desirable to use quicklime in place of the air-slaked lime recommended by Dalrymple, slaking it with water in the usual manner before adding to the dip, while the addition of ferrous sulphate appears to be unnecessary.

dipping is to prevent as nearly as possible any engorged females dropping to the pasture and there laying eggs which in time may develop into young ticks. In order to do this it is necessary to dip at intervals short enough so that no tick after getting on the cattle will have time to mature and drop off before the next dipping. An interval between dippings of two weeks is considered most satisfactory. This interval, however, may be increased somewhat if necessary, but it should never be greater than three weeks.

In freeing a farm of ticks the dipping should not be discontinued until it has been determined with certainty that the cattle and premises are free of ticks. It should be borne in mind that it is almost impossible to determine by a few inspections, even if carried out with great care, that animals are free from ticks. If the treatment is discontinued and a few unobserved ticks are still on the animals, these, on maturing and dropping, are likely to give rise to a new brood of young ticks. Moreover, even if the cattle are actually free from ticks, the fact should not be lost sight of that there may still be engorged females, eggs, and seed ticks on the premises. This is most likely to be the case during the colder part of the year when the development of the tick on the ground progresses slowly and also when any seed ticks that may be present are likely to be slow in reaching the cattle because of inactivity resulting from the low temperature.

RULE FOR CALCULATING THE CAPACITY OF A DIPPING VAT.[1]

a. Reduce all dimensions to the same denomination, feet or inches.

b. Add the length of the bottom of the vat to the length at the water line.

c. Add the width of the bottom to the width at the water line.

d. Multiply these sums (*b* and *c*) together.

e. Multiply the length of the bottom by the width of the bottom.

f. Multiply the length at the water line by the width at the water line.

g. Add together *d*, *e*, and *f*.

h. Multiply this sum (*g*) by one-sixth the perpendicular depth from the water line to the bottom, which gives the capacity of the vat in cubic feet or cubic inches.

i. If the capacity in cubic inches has been obtained, divide *h* by 231; if the capacity in cubic feet has been obtained, divide *h* by 0.1336. In either case the result will be the capacity of the vat in gallons.

This method is mathematically accurate if the vat is set level, but if it is set so that it is slightly lower at one end than at the other, as is usual, the true capacity can not be obtained by this method. If,

[1] This rule has been adapted by Dr. B. H. Ransom from a mathematical formula for calculating the volume of a prismoid.

however, the figures for the width at the water line and the depth are taken from measurements at the middle of the vat the results obtained will vary only very slightly from the actual capacity.

SPECIFICATIONS FOR THE CONSTRUCTION OF A CONCRETE CATTLE-DIPPING VAT.

SITE.

The site selected for the location of the vat should be dry and of sufficient size to admit of the construction of the chute, the dripping pen, and at least two additional pens—one for holding the cattle prior to dipping and the other for retaining them after dipping until sufficiently dried.

EXCAVATION.

The excavation should be made 1 foot wider and 1 foot longer than the inside dimensions of the vat and should conform to its shape. The inside dimensions of the vat are shown on the drawings (fig. 1) and are as follows: Length at top of vat, 26 feet; bottom, 12 feet. Width at top, 3 feet; at bottom, 1½ feet. Depth, 6½ feet.

The sides and bottom of the excavation should be firm and solid, as they are to serve for the outside forms in casting the concrete. If it is necessary to do any filling in order to conform to the shape of the vat, the filling should be puddled and thoroughly rammed until solid, because the stability of the concrete depends on the foundation.

FORMS.

The wooden forms should be constructed of 1-inch boards and 2 by 4 inch braces, the boards being nailed to the outside face of the braces, as shown in the drawings. The sides and end walls should be built 8 inches higher than the surface of the ground, which should be level.

CONCRETE.

The concrete should be made of 1 part of cement, by measure, 2½ parts of sand, and 5 parts of broken rock or gravel. The cement should be of a standard brand of Portland, the sand clean and coarse, and the broken rock from about ¼-inch pieces to not larger than will pass in every direction through a 1-inch ring.

Mixing.—The mixing should be done on a tight wooden platform or in a tight box. The sand and stone should be measured in a bottomless box, 2½ feet long by 2 feet wide by 1 foot deep, having a capacity of 5 cubic feet. A convenient size of batch to mix is one consisting of 2 bags of cement, 1 measure (5 cubic feet) of sand, and 2 measures (10 cubic feet) of stone.

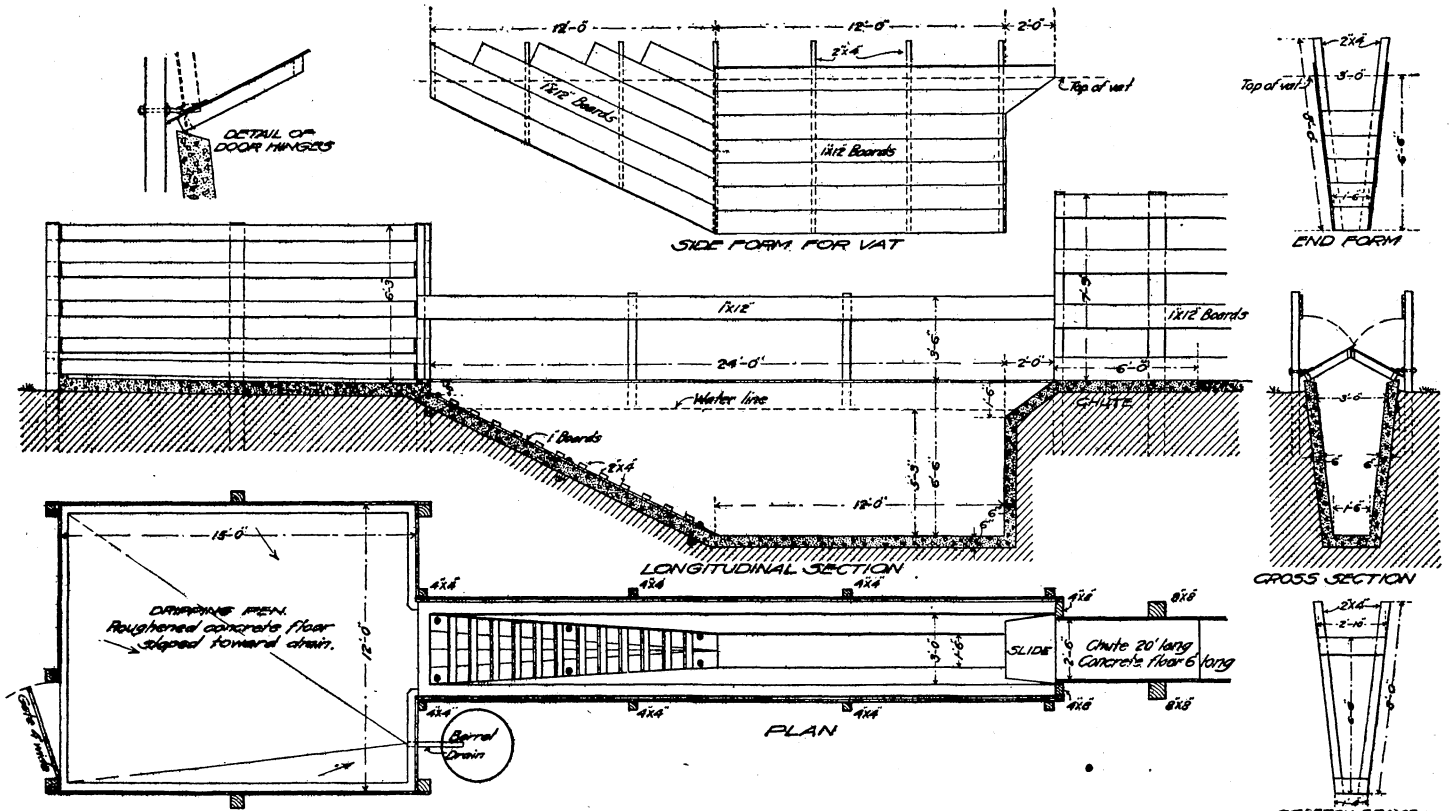

FIG. 1.—Plans for a concrete dipping vat.

The sand is measured out first and the cement emptied on top, after which the two materials are thoroughly mixed together, dry. In the meantime the stone may be measured out and thoroughly drenched with water. The cement-sand mixture is mixed with water and the resulting mortar then combined with the stone. The stone should be shoveled on the mortar, which has been previously spread out in a thin layer. Mixing should continue until the stone is thoroughly coated with mortar, more water being added during the mixing process if necessary.

Laying.—Before laying the concrete the molds should be set and thoroughly braced into place. The side forms may be suspended in the excavation with their lower edges 6 inches from the bottom by means of crosspieces nailed to the uprights and of sufficient length to rest on supports located several feet from the edges of the excavation. The concrete for the bottom and incline is deposited first, this mixture being of a consistency that water will flush to the surface on ramming. The mixtures for the sides and end should be very wet and should be thoroughly puddled into place. The consistency of the concrete for the side walls should be such that it will run off the shovel unless handled quickly.

The laying of the concrete should be done, if possible, in one operation, in order that there may be no joints between the new and old work. If it becomes necessary to lay the concrete on two or more days the surface on which the new concrete is to be deposited should be washed thoroughly clean and coated with grout of pure Portland cement and water mixed to the consistency of cream. The new concrete should be placed before the grout has set. Extreme care should be taken to prevent dirt from falling in on top of the deposited concrete.

The forms should not be removed until the concrete is set, which in moderate weather will have taken place in about 24 hours. In damp, cold weather at least 48 hours should be allowed before removing the forms. It will be advisable, especially in water-soaked ground, to allow the forms to remain in place for one week before removal.

Finishing coat.—Before applying the surface coat dampen the walls and floor thoroughly. Cover the entire exposed surface of the floor and walls with a coating one-half inch thick of cement mortar composed of Portland cement 1 part, sand 2 parts. Coating to be floated and troweled to a smooth finish.

WATERPROOFING.

If the earth around the vat is thoroughly drained the vat may be waterproofed by painting the surface coat, but painting the surface

will not give satisfactory results if there is ground water to seep in. The paint may be good hot pine tar, or gas-house tar cut with naphtha or gasoline and applied with a brush, or after the mortar coat has hardened the inside of the vat may be painted with an oil-cement paint made as follows:[1] Mix enough water with Portland cement to make a fairly stiff paste; add to this 5 per cent of heavy petroleum residuum oil based on the weight of the cement, and mix thoroughly until the oil entirely disappears, then add more water and stir until a paint of the consistency of cream is formed. This paint should be applied with a brush and should be well rubbed into the surface. Should the mortar coat be omitted the paint coat should be applied directly to the surface of the concrete.

EXIT INCLINE.

If the exit incline is to have a false wooden floor it will be necessary to embed iron bolts in the concrete, to which the wooden floor may be fastened. Before the concrete incline is laid embed in the dirt three pieces of 2 by 4 inch scantling, placed at the top, center, and bottom of the incline. The bolts should extend through these pieces and should be placed with the head next to the dirt. The bolts should be long enough to extend through the concrete and the inch boards of the floor, so that the wooden floor may be securely fastened.

The exit incline may be constructed without a false bottom. In this case bricks laid on edge and embedded in the concrete will form cleats to allow the animals to leave the vat readily. The cleats should be about 14 inches apart and project about 2 inches.

SLIDE.

Cover the slide with a sheet of boiler iron properly fastened to the cement.

COVER.

The cover of the vat consists of two leaves hinged on posts set 3 feet in the ground along each side of the vat. The leaves are 2 feet 6 inches wide, and when open rest against the upper part of the posts to which they are hinged and serve as splashboards. The details of the hinge[2] used and the method of setting it are shown in the drawings. When the leaves are open their lower edges are just above the top of the side walls, which are given a slope inward for the purpose of conducting the dip running from the splashboards back into the vat. Removable doors should be constructed to close the triangular openings left at the ends of the vat when the cover is closed. The hinges may be made by a blacksmith.

[1] These directions for the oil-cement paint are furnished by the Office of Public Roads of the United States Department of Agriculture.

[2] This hinge and the method of setting it for the cover of a dipping vat have been copied from an article by William Taylor Heslop in the Agricultural Journal of the Union of South Africa, Pretoria, vol. 1, No. 1, 1911, pp. 38–43.

DRIPPING PEN.

Construct a dripping pen about 12 by 15 feet at the head of the exit incline. The floor should be of concrete prepared as previously described for the vat and laid in a similar manner. The floor should be pitched toward a corner of the pen, where a pipe should be laid in the floor to carry the drippings into a barrel sunk in the ground. The drippings thus caught may be returned to the vat after settling. The floor should be roughened to prevent the cattle from slipping.

CHUTE.

The chute leading to the vat should be built 30 inches wide and 20 feet long, and the receiving and retaining pens should be of a size to take care of the animals to be dipped.

BILL OF MATERIALS FOR VAT, DRIPPING PEN, AND CHUTE.

LUMBER FOR FORMS.

8 pieces 1 by 12 inches by 14 feet long.
13 pieces 1 by 12 inches by 12 feet long.
2 pieces 1 by 12 inches by 9 feet long.
2 pieces 1 by 12 inches by 6 feet long.
2 pieces 1 by 12 inches by 4 feet long.
8 pieces 2 by 4 inches by 8 feet long.
2 pieces 2 by 4 inches by 7 feet long.
2 pieces 2 by 4 inches by 6 feet long.
2 pieces 2 by 4 inches by 4 feet long.
2 pieces 2 by 4 inches by 2 feet long.
7 pieces 1 by 6 inches by 12 feet long for crosspieces for inside of forms.

LUMBER FOR DRIPPING PEN.

7 pieces 6 by 6 inches by 10 feet long for posts.
10 pieces 1 by 8 inches by 16 feet long for side rails of pen.
5 pieces 1 by 8 inches by 12 feet long for side rails of pen.
5 pieces 1 by 8 inches by 8 feet long for side rails of pen.

The covers can be made from the lumber used in making the forms, and the lumber for the exit incline can be gotten in the same way.

The 4 by 4 inch posts to which the cover is hinged may be made from 2 by 4 stuff by spiking together.

End form to be made solid.

HARDWARE AND IRONWORK.

6 bolts, ½ by 10 inches, with nuts and washers, for false floor of incline.
1 sheet of ¼-inch boiler iron cut to shape of slide; plate bored and countersunk for 4 screws.
4 pairs hinges for covers.
3 heavy T hinges and screws for gate of dripping pen.
1 heavy iron bolt to fasten gate.

CONCRETE.

VAT.

Cement, 10½ barrels (42 bags).
Sand, 3¾ cubic yards.
Stone, 6¼ cubic yards.

DRIPPING PEN AND CHUTE.

Cement, 5½ barrels (22 bags).
Sand, 1¾ cubic yards.
Stone, 3½ cubic yards.

A 26-foot vat has been used extensively for eradication purposes with satisfactory results. However, if it is desired to lengthen the body of the vat on account of large numbers of cattle to be treated, or to make it conform to the bureau's requirements for the treatment of cattle for movement as noninfectious, there should be added to the amount of concrete material for each lineal or running foot, cement, 0.37 barrel; sand, 0.12 yard; stone, 0.24 yard.

By some a dripping chute is regarded more satisfactory than a dripping pen. One of the advantages that it has is that the cattle are held in line in the order in which they have been dipped, thus making it possible to remove one or more of them at a time as soon as they have drained sufficiently, in order to make room for others. In using the dripping pen this is not practicable, and it is necessary to wait until the last animal dipped has drained sufficiently and then remove them all together.

In case it is desired to construct a dripping chute it should be located at the head of the exit incline in line with the vat. It should be about 36 inches wide. The length will depend on the number of cattle it is desired to accommodate at one time, it being necessary to allow 4 to 5 feet for each. A length of from 20 to 40 feet is considered a convenient size for small herds. The floor should be made of concrete and sloped toward the vat. The dip should not be permitted to run directly into the vat, but should be collected in a barrel to settle, as shown in the case of the dripping pen. The floor at the sides should be raised about 2 inches in the form of a curb to keep the dip from running off.

SPECIFICATIONS FOR THE CONSTRUCTION OF A BRICK DIPPING VAT.

MATERIALS.

Bricks.—All bricks should be hard burned.

Mortar.—The mortar used in laying the bricks should be composed of 1 part of Portland cement and 3 parts of clean, sharp sand. The plaster for facing the inside of the vat should consist of 1 part of cement and 2 parts of sand.

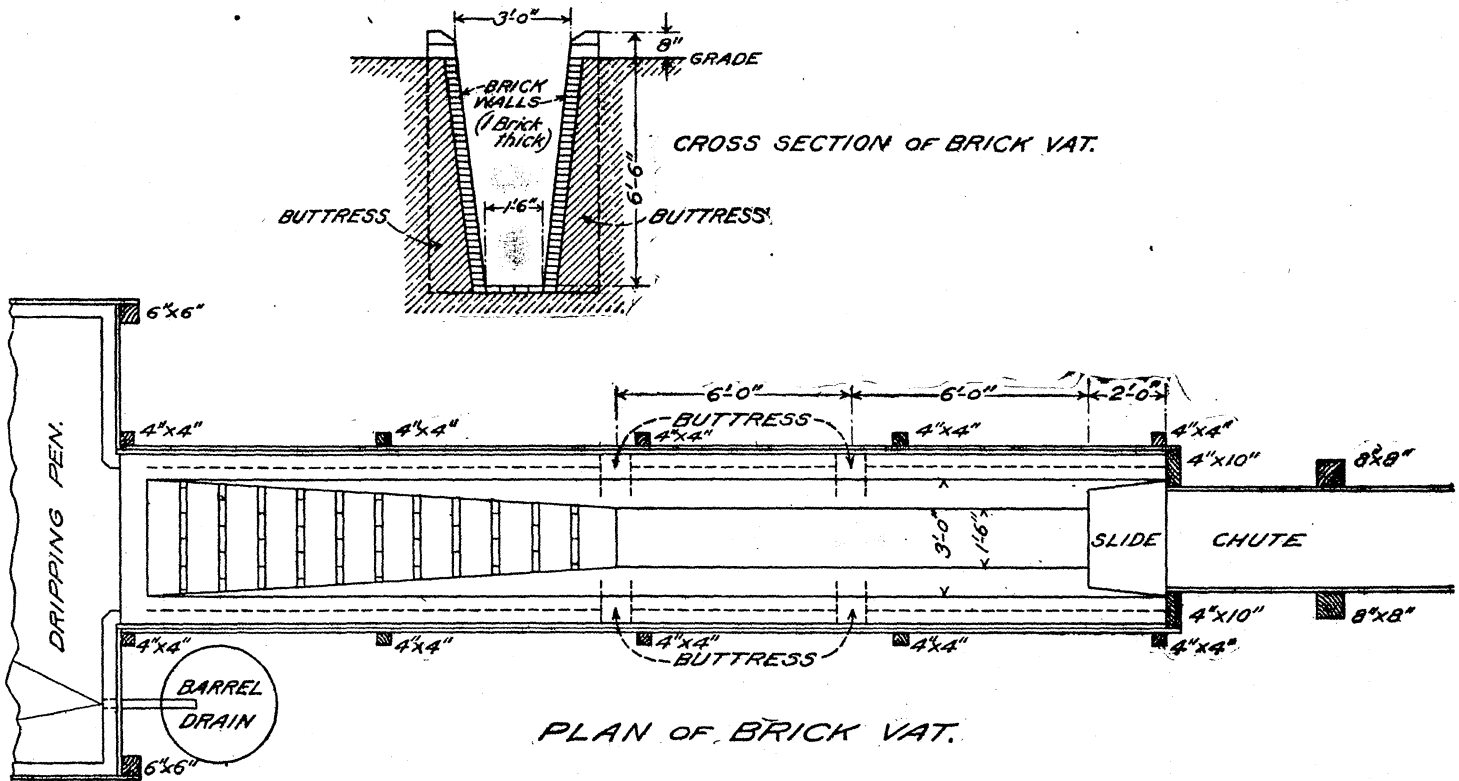

FIG. 2.—Plan for a brick dripping vat.

EXCAVATION AND CONSTRUCTION.

Excavate the ground 1 inch wider than the outside width of the vat. Lay up the walls one brick thick, all bricks to be stretchers; that is, the long way of the brick to be laid the long way of the wall.

The sides are to be laid with level courses and the batter or slant is made by setting back each succeeding layer of bricks. Break joints in every course. Rake out the horizontal mortar joints at least ½ inch from the inside face of the wall. This will give a key for the cement-mortar facing. Build buttresses or piers where indicated on plan and shown on cross section. (See fig. 2.) The buttresses are to be one brick wide at the bottom and to extend far enough from the inside face of the vat so that the outside face will be plumb and finish even with the outside face of the coping or curb at top of vat. The buttresses should be laid as a part of the wall and should be bonded into the wall. The bottom is laid after the walls are up and the bricks are laid flat. The exit incline is laid with bricks laid on edge, and every fifth course is to project 2 inches above the face of the incline to form cleats. The mortar between the ends of the bricks which form the cleats should be cleaned out in order to permit the dip to run back. In laying up the walls fill in with mortar between the dirt and outside face of wall.

The side walls above the ground may be finished and beveled by using a heavy coating of cement mortar, or the top may be finished by laying the last two courses of bricks on edge and so that the bricks are headers; that is, the bricks are laid at right angles to the face of the wall. Cover the inside faces of walls, exit incline, floor, and slide with a ¼-inch coat of cement mortar mixed in the proportion of 1 part of cement to 2 parts of sand. Trowel the surface with a steel trowel to make smooth.

The dripping pen and the chute are to be floored with bricks. If the ground is very firm, the bricks may be laid flat, but if the ground is not firm a more satisfactory floor will be produced by laying the bricks on edge. The bricks should be laid in a bed of cement and the joints grouted with cement grout. Cement grout is made by mixing neat cement with water until it has the thickness of cream. Before any of the brickwork is coated with mortar the bricks should be thoroughly washed, and they should be thoroughly wet before the plaster coat is applied. The dripping pen and chute are to be plastered with a ¼-inch coat of cement mortar, and before it is completely set the surface is to be rubbed with a brush broom or a heavy stable broom.

BILL OF MATERIALS FOR BRICK VAT, DRIPPING PEN, AND CHUTE.

Brick for vat		2,560
Brick for dripping pen and chute	if laid on edge	1,320
	if laid flat	780
Cement	sacks	28
Sand (for mortar)	cubic yards	1.6